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Procedia Social and Behavioral Sciences 7(C) (2010) 130–138

Procedia Social and Behavioral Sciences

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International Conference on Learner Diversity 2010

Mobile Learning Framework for Lifelong Learning

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Abstract

This paper proposes a conceptual framework for mobile learning applications that provides systematic support for mobile lifelong learning experience design. It concerns four perspectives: generic mobile environment issues, learning contexts, learning experiences and learning objectives. The paper also explores crucial factors and design requirements for the mobile learning environment. It also suggests how mobile learning applications can be designed with an understanding of these factors and requirements and further applied to lifelong learning. The proposed framework provides forward engineering support for the successful design of the future mobile lifelong learning systems.

Keywords: Mobile learning; Conceptual framework; Lifelong learning, Learning applications, Design system

1. Introduction

In the last one hundred years, education has evolved from being exclusive to the elite to being accessible to everyone. The mode of learning has also evolved from learning solely in the classroom to distance learning and the virtual classroom. Technologies have also helped the process of delivering content to learners. According to Hargreaves (2003), a knowledge society is a learning society. A learning society has the responsibility of providing avenues for its people to seek knowledge. With the help of technology, knowledge acquisition is no longer restricted to the classroom. Hence, indirectly, technology can help cultivate lifelong learning.

1.1 The promotion of lifelong learning through ICT

Although there is no exact definition of lifelong learning, the term has been interpreted as the training of a workforce capable of adapting to a rapidly changing world (Sharples, 2000; Knapper & Cropley, 2000). Knapper and Cropley mention that the basic idea of lifelong learning is deliberate learning that can and should occur throughout each person's life. Rozhan and Hanafi (2007) relate lifelong learning to the use of technology. They define the concept of lifelong learning as life-wide learning that hinges its successful endeavour on the potential of distance education via computer-mediated communication.

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doi:10.1016/j.sbspro.2010.10.019

Lifelong learning is often used in relation to adult education or continuing education. The famous saying of seeking knowledge from the cradle until one dies illustrates the nature of lifelong learning. It pictures the various types of education that one has to go through in one's life: formal education, non-formal education and informal education. Formal education involves structured learning with a planned curriculum, proper classroom and qualified teachers; non-formal education involves being outside formal settings such as on a field trip to a museum; and informal education occurs out of spontaneous situations (Maarschalk, 1988). Therefore, all forms of education that one receives after one has completed one's formal education can be classified as part of the process of lifelong learning. The aim of lifelong learning is to improve knowledge, skills and competence with a personal, civic, social or employment-related perspective (Yamat et al., 2007). The unique characteristic of lifelong learning is the fact that it centres around individuals, i.e. the learners themselves. According to Vavoula and Sharples (2001), at the core of the learning practice is the learner: a person with certain physical characteristics who assumes a number of social roles and who has a number of characteristics that relate to how they practise learning. Because of the fact that it centres on the individual, the use of technology in delivering becomes crucial. The use of technology can provide a flexible learning framework which is often preferred by adult learners.

2. Mobile learning

Only half a century ago, communication via telephone provided the ability to talk to someone from a distance. However, the capability of the telephone has expanded to include other features. Nowadays, mobile devices combine the features of traditional telephone, text messaging, a diary, wireless internet connection and certain telephones come with personal computer capabilities. Earlier research on the use of mobile phones in delivery of educational content was restricted to the features available on mobile phones. For instance, a study conducted in Africa showed the use of the short messages system in communicating with students across the continent. A study in Japan showed that students in Japan prefer to use the email function on their mobile phones. Therefore, when designing mobile materials for their English subject, the element of email is also included (Thornton & Houser, 2005).

Designing content for e-learning differs from designing content for mobile learning. This may be due to many factors which include the physical factor. Lessons delivered using computers and the World Wide Web can be viewed using a 12–19 inch screen. Computers can hold large memory and classroom lessons can be conducted with computers as the main medium. This is known as computer aided learning. It is a norm to print materials from the internet but this might not be the case for mobile learning. In delivering lessons through mobile devices, there are a number of aspects that need to be looked into.

3. A theory of mobile learning

Designing materials to be uploaded onto technology-based media might require the use of a number of theories, namely learning theories and instructional design theories. Imitating the procedures of designing e-learning materials, where one would employ any of the instructional design models to ensure that the materials are designed with some discipline in mind, designing materials for mobile devices could use the same technique.

However, Sharples et al. (2005) mention that most of the learning theories widely used is based on the assumption that teaching and learning take place in the classroom. Since this might not be the case for today's process of teaching and learning, there might be a need to develop a theory of mobile learning.

In order to develop a theory of mobile learning, there are a number of crucial factors that need to be considered. For a start, there is the underlying assumption that learners are on the move all the time. Therefore, what they learn may not be restricted to what was stipulated in the curriculum. When a learner learns a learning item in the classroom, they will then take the new knowledge with them outside the classroom. Once outside, informal discussions might take place with fellow learners that require the knowledge to be revisited and reflected on. When reflecting, there might be a need for the learner to investigate the matter further by downloading related materials from the internet. New knowledge is now formed. The process is non-stop and can be recursive. This is probably what Dewey (1916) meant when he said that all communication is educative.

This relates to the second factor in postulating a theory of mobile learning, and that is to consider the learning that takes place outside the classroom. A study by Vavoula in Sharples et al. (2005) found that 51 per cent of everyday adult learning takes place either at home or in the office. Although the study does not provide a definition for learning or how learning was measured, it shows that a certain level of knowledge enhancement has occurred. The

study further describes that learning takes place in various places: 21 per cent of learning happens outside the office at the workplace, 5 per cent of learning happens outdoors, 2 per cent happens at a friend's house, and 6 per cent happens at places of leisure. It is also reported that 14 per cent of learning takes place at other locations and 1 per cent occurs on forms of transport. The fact that only 1 per cent of learning takes place while learners are on the move indicates that mobile learning does not equate to physical movement. However, the study proves that learning takes place anytime and anywhere and it can take place outside the classroom environment. This provides opportunities for educationalists to provide formal content that can be learnt in informal surroundings.

Thirdly, developing a theory of learning must enable successful learning. Successful learning is related to effective learning. According to the US National Research Council (1999), effective learning constitutes four elements: (1) learner centred, (2) knowledge centred, (3) assessment centred and (4) community centred. Learner centred deals with positioning learners at the centre of the educational process (Brindley, 1984). Hence, learners are responsible for their acquisition of knowledge and the building of skills. Knowledge centred deals with the curriculum which is built on validated knowledge, taught effectively and efficiently. Assessment centred, on the other hand, focuses on evaluating learners' ability, diagnosing problems and offering guidance which may lead to success in learning. Community centred promotes the sharing of knowledge and learners supporting each others' learning. These four elements adhere to the socio-constructivist approach to the process of learning where learning is not a lonely journey but rather an individual effort with environment and community support.

Finally, a theory of mobile learning must also consider the use of ubiquitous technology and how the learning community is responding to it. In the UK for the year 2005, a study revealed that 95 per cent of young adults aged between 15 and 16 owned mobile phones (*Daily Mail*, 15 February 2005: www.literacytrust.org.uk/Database/texting.html#fog). A similar study conducted in Malaysia revealed that 100 per cent of higher education learners aged between 18 and 21 owned mobile phones (Abd Rahman et al., 2009). Those studies further indicate that learners are equipped with devices that enable them to learn anytime and anywhere. They present educationalists and instructional designers with opportunities to design instructions that could be delivered using those devices.

The above argument leads to a conclusion that is presented by five questions posed by Sharples et al. (2005). These five questions act as a checklist for developing a theory of mobile learning:

(1) Is it significantly different from the current theories of classroom, workplace or even lifelong learning?
(2) Does it consider the mobility of the learners?
(3) Does it include informal and formal learning?
(4) Does it view learning as a constructive and a social process?
(5) Is learning analysed as personal and mediated by technology?

Therefore, in designing a mobile framework for lifelong learning, the theory of mobile learning has to be established before embarking on other issues.

However, the features discussed so far have not been formulated into a tested theory as yet. As that is the case, one could argue that it might still be relevant to use existing theories of learning as the pillars for designing activities for mobile learning.

4. General requirements for mobile learning

Lifelong learning happens not only in learning institutions such as community colleges or higher learning institutions but learning can also happen anytime and anywhere according to the needs of the individual. Therefore, providing the avenue for mobile knowledge acquisition is vital.

Thus, including the elements of lifelong learning in the design of a mobile framework is essential. In many instances, technologies can be seen as the supporting factor of learning. Sharples et al. (2000) outline a number of general requirements that have to be considered when designing mobile materials. The requirements include technology that is:

(1) **highly portable** – so as to support learning whenever and wherever;
(2) **individual** – the design should be able to support individual learning, cater for individual learning styles and be adaptable to learners' abilities;
(3) **unobtrusive** – learners should be able to retrieve knowledge without the technology becoming a deterrent;

(4) **available** – enabling communication with friends, experts and/or teachers;
(5) **adaptable** – the context of learning should be adaptable to situations and the individual's skills and knowledge development;
(6) **persistent** – able to manage the learner's learning despite the changes in the technology itself;
(7) **useful** – useful to learners for everyday chores;
(8) **user-friendly** – easy for people to use and must not create technophobia among new users.

However, these requirements are not easy to meet. For instance, highly portable devices mean having devices that are light, easy to carry and are not restricted by network coverage. If a device is operated in a remote area, there should not be cases where learning cannot take place simply because the content cannot be downloaded. Although the issue of network coverage is real and serious in a developing country, ways should be sought to overcome technical problems of infrastructure.

5. Framework for mobile learning

The general requirements supplied by Sharples et al. (2005) are also shared by Parsons et al. (2007). They argue that because of the uniqueness of mobile learning, one cannot use an e-learning framework for mobile learning materials. The benefits and limitations of mobile devices have to be noted and addressed accordingly in designing learning materials for mobile usage.

There are a number of mobile content frameworks available to assist the design and development of mobile content materials. Liu et al. (2008) mention that there are four elements that needs to be incorporated into the design of a mobile framework. Their framework was developed based on the reflections and the results of action research from the Nokia Mobiledu Project that they conducted. With mobile learning activity design as the core of the framework, the four elements include (1) requirement and constraints analysis, (2) mobile learning scenario, (3) technology environment design and (4) learner support services design. Figure 1 illustrates the framework.

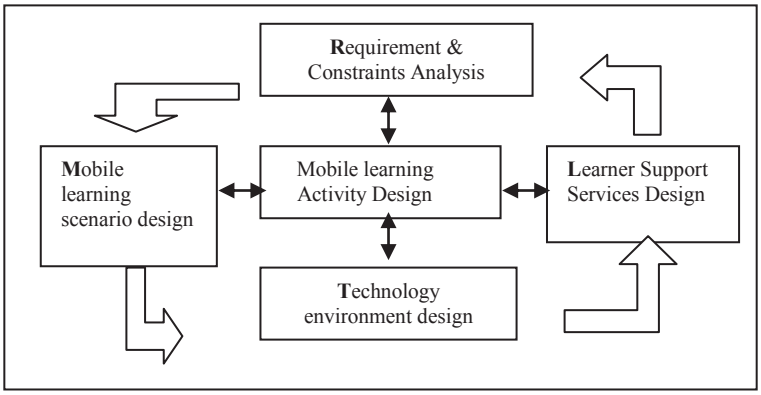

Figure 1. Design framework for mobile learning (Liu et al., 2008)

Requirement and constraints analysis looks at the demand for mobile learning by studying two levels of requirement analysis: the general level and the concrete level. The general level seeks to find the answers to the common features of mobile learning, the position and status of ICT in education, the potential users and existing mobile learning applications as well as motivations and expectations. Meanwhile, concrete requirement analyses the users and the users' learning environment. It comprises potential users' attitudes, skills, experiences, use patterns, learning characteristics, motivations, learning tasks and possible barriers as well as possible mobile learning situations, environment and influencing factors. Liu et al. (2008) emphasise that the understanding of user needs and the factors that influence their learning is crucial to the design of mobile learning activity.

Mobile learning scenario is another factor that is essential to mobile learning activity design. Liu et al. (2008:186) describe mobile learning scenario as '… describing how learners with certain characteristics in certain settings carry our various activities to achieve learning goals'. Describing a mobile learning scenario requires those involved to brainstorm and translate the results onto a storyboard. Focus groups are formed to discuss various aspects of a

mobile learning scenario and finally an evaluation is conducted to see the significance of mobile learning in increasing the level of learners' motivation.

Mobile learning technology environment is also a contributing factor to the design of mobile learning activity. 'Environment' constitutes elements such as database, platforms, networks and other technological aspects of mobile learning. In the Nokia Mobiledu Project, the platform used is MUPE (Multi-user Publishing Environment). Liu et al. (2008) claim that since MUPE operates on Java, the system is usable with most mobile phones. The technology environment indirectly determines the types of activity constructed. In the case of Mobiledu, activities included multimedia representation of the content. This means that activities were designed to be text based, audio, animation, video and 3D. The activities were also designed to encourage learner control.

Learners also need support services to increase their confidence and competencies as well as to overcome any arising difficulties. Liu et al. (2008) suggest four areas that could be addressed in support services: (1) consulting services, (2) blended learning services, (3) training and (4) community support services.

We think that the framework proposed by Liu et al. (2008) is comprehensive in the sense that it has taken into account all the necessary factors that concern the users, the learning itself and the environment in which the learning will operate.

Another similar framework is offered by Mohammad et al. (2007). Mohamed et al. (2007) view their work as an extension of e-learning. Their work revolves around the idea of adapting e-learning materials for the use of mobile devices. They argue that in doing so, a number of key points have to be addressed. They have identified a few dimensions that need to be adapted. The dimensions are context, user, mobile device and connectivity. They too analysed the context in which the mobile learning will be used, look at the users and their characteristics as well as learners' learning strategies. They studied the technical aspects of the technology environment in which the mobile learning will be operating such as connectivity speed and cost. They also considered the mobile devices and the platforms on which those devices operate.

The areas mentioned by Sharples et al. (2005), Liu et al. (2008) and Mohammad et al. (2007) are also shared by Parsons et al. (2007). Parsons and colleagues specify that there are four requirements for a general framework for mobile learning: (1) generic mobile environment issues, (2) mobile learning contexts, (3) learning experience and (4) learning objectives.

The framework offered by Parsons et al. (2007) was generated from their studies of many successful mobile learning programmes. Parsons et al. (2007) propose a framework that could be used in designing materials for mobile learning. They suggest that the design of a mobile learning framework should detail the entire process from determining the environment in which it will be operating to the steps needed in designing the actual activities. Therefore, the framework includes generic elements, which are also found in other frameworks, as well as enhancement of the learning experience.

According to Parsons et al. (2007), generic mobile environment issues encourage a close examination of the following: mobility, user interface, the use of a rich media and communication support. A study conducted by Dewitt (Saedah and Dewitt 2007) also demonstrates the use of text messages among secondary school students and how this promotes collaborative learning. Parsons et al. (2007) classify this as user roles and profiles. Löwgren and Stolterman as mentioned in Parsons et al. (2007) categorise it as core, periphery and context. The second element proposed by Parsons et al. (2007) is mobile learning contexts. They categorise this element into six dimensions: (1) identity, (2) learner, (3) activity, (4) collaboration, (5) spatial–temporal and (6) facility. They place the first four as situational context for mobile learning and the last two as environmental context. Similar to the general requirements which Sharples et al. (2005) outlined, 'identity' involves a closer look at the users themselves and the role that they play. For example, do the users take up the role of a learner or teacher? In considering the 'learners', one is forced to look at a number of psychological factors which include learners' needs, their study preferences, motivation levels and their experience in using the devices. The last two elements proposed by Parsons et al. (2007) are learning experience and objectives. They noted two useful metaphors in mobile design: cinematic metaphor and the game metaphor. The former deals with story elements and narrative. The latter deals with the features of games such as excitement, competition and popularity. They also stressed that content should be organised accordingly.

6. Mobile design framework in lifelong learning

This paper proposes a mobile learning design framework for lifelong learning which is largely based on the work done by Parsons et al. (2007). Although the key elements remain the same, adjustments have been made to suit the purpose of the content for lifelong learning. The proposed mobile learning framework is designed based on four

elements: (1) theories of learning, (2) generic mobile environment, (3) mobile learning context, (4) learning experience and objectives:

6.1 Theories of learning

Theories of learning have played an important role in the design of instructional materials. They determine the direction of the designed materials and reflect the specific approach used. Therefore, we find that it is essential to include theories of learning in the framework. If one looks at the current practice, constructivism works hand in hand with e-learning materials. It is believed to be equally true with mobile learning activities. Students can always construct new knowledge with the information that they get from their mobile content activities. However, mobile devices with the restrictions that they have, i.e. small screen, nugget input, etc, might also be an excellent device for drill and practice exercise. Drill and practice exercise is characteristic of behaviourism, especially when coupled with the fact that with mobile devices, feedback is almost immediate. The feedback itself can act as a motivator to the students hence encouraging them to continue with the exercises given.

Activities posed on mobile devices also allow students to reflect on what they have learnt in the classroom. As a result of reflection, students might recognise their problems and address their difficulties as soon as possible. Hence the use of cognitive theory of learning is essential in the mobile lifelong learning context.

6.2 Generic mobile environment

Under the generic mobile environment issues, we might need to collect demographic data from the parties involved in the learning scenario (Parsons et al., 2007). This is categorised as user dimension. Under user dimension, there are two categories: user identity and learners. Thus, data need to be collected from these two parties. In a particular project, the identity of the users could be the core users or the secondary users. Those who perform learning activities by using the device features (e.g. the students) are considered as core users. Those who are involved indirectly with learning activities but somehow have roles to play (e.g. the content provider or instructor) are considered as the secondary users. The assessment of participants' mobility and their gadgets should also be analysed. Based on this information, the designer should then design an appropriate interface, include the necessary media types and establish the support service. The context will be the scenario in which the learning takes place, for instance the learning scenario in an institution or a society.

In terms of mobility, there is always the question of whom or what is 'mobile' in delivering mobile education. Are the learners mobile, are the devices mobile or is the content designer or content provider mobile? Subscribing to the first denotes analysing how mobile devices are used by the learners. Examining learners' mobility means looking at the role that mobile users play and the learners' profile.

Another environment issue that one has to consider is the user interface. It is a known fact that mobile devices such as mobile phones have small screens. Even smartphones such as the iPhone or Personal Digital Assistant (PDA) do not have a large enough screen. However, as time progresses, screens for mobile phones offer better resolution and do not strain the eyes as much. Still, it is insufficient to solve the problem of materials restriction. Another problem that might occur which relates to the screen is the design of the interface. Preece et al. (2007) emphasises that it is necessary to present information on a screen in a way that helps users to perform tasks. At the same time, the advances of technology nowadays have enabled interfaces to be designed beyond the individual user. In other words, interfaces are designed to cater for small- and large-scale social interactions for people on the move.

6.3 Mobile learning context

The use of technologies in the acquisition of knowledge is often seen as a supporting tool rather than learning an item solely through the media. Thus, mobile learning in a lifelong learning context is often used in a blended learning mode, either as a pre-activity or a post-activity. Putting mobile learning in context proves to be fruitful as can be seen in many projects. An example of such a project is the Ambient Wood Project conducted by Rogers and Price (2004). The Ambient Wood Project explains that teaching using classroom-based and mobile methods is disparate in many ways. Placing students in the wood to perform scientific research has allowed an integrated approach in the teaching of science. Students were doing extensive collaborative work with their peers using their digital devices. Discussions, exchanging notes, checking facts, seeking elaboration and other information-gathering activities can be done using their mobile devices while the students are in the actual surroundings of their scientific research.

Mobile learning has one distinctive feature and that is the encouragement of collaborative activities as proven by the Ambient Wood Project. Students' discussions, debates and prediction making are enhanced through the employment of mobile devices. The collaboration activities can be between students, students and teachers, or students and other sources.

The issue of spatial–temporal as mentioned by Parsons et al. (2007) is relevant in the sense that it deals with time and/or location. It also puts significance on the issue of schedules and venues. The issue of facility is another relevant issue, as most projects work on already available service providers and use available mobile devices. However, with big budgets and good administrative support, specially designed devices might be used. This will provide a richer facility context.

6.4 Learning experience and objectives

Touching on the issue of learning experience requires a revisit to user experience of usability. Preece et al. (2007) comment that system designers should not only concern themselves with usability goals but also with the impact of the design on the user. According to Preece et al. (2007), not only do users look for a usable system but they also look for a pleasing and engaging experience. Therefore, elements such as enjoyment, user satisfaction and motivation are taken into account. Apart from that, content should also be well organised. An organised content could enhance understanding and thus promote learning acquisition. An organised content must be attached to goals and objectives. As with any other form of teaching materials, goals and objectives provide sense of direction. Coupled with this is the fact that when there are goals and objectives, feedback can be obtained. If one organises the content in a narrative form, i.e. in a story form, learners will be able to explore an issue on a personal basis as they will be directly involved in the learning. As such the narrative mode also allows students to reflect on what they have learnt, illuminating the process of learning, and gradually provides an organised structure of knowledge (Parsons et al., 2007).

Another factor that could engage learners in dealing with the designed materials is challenge. Activities that draw on conflict and possess competitive elements might be more interesting to the learners. Indirectly, this inserts the fun element into the materials designed (Prensky 2001). Figure 2 summarises the mobile learning design requirement framework for lifelong learning.

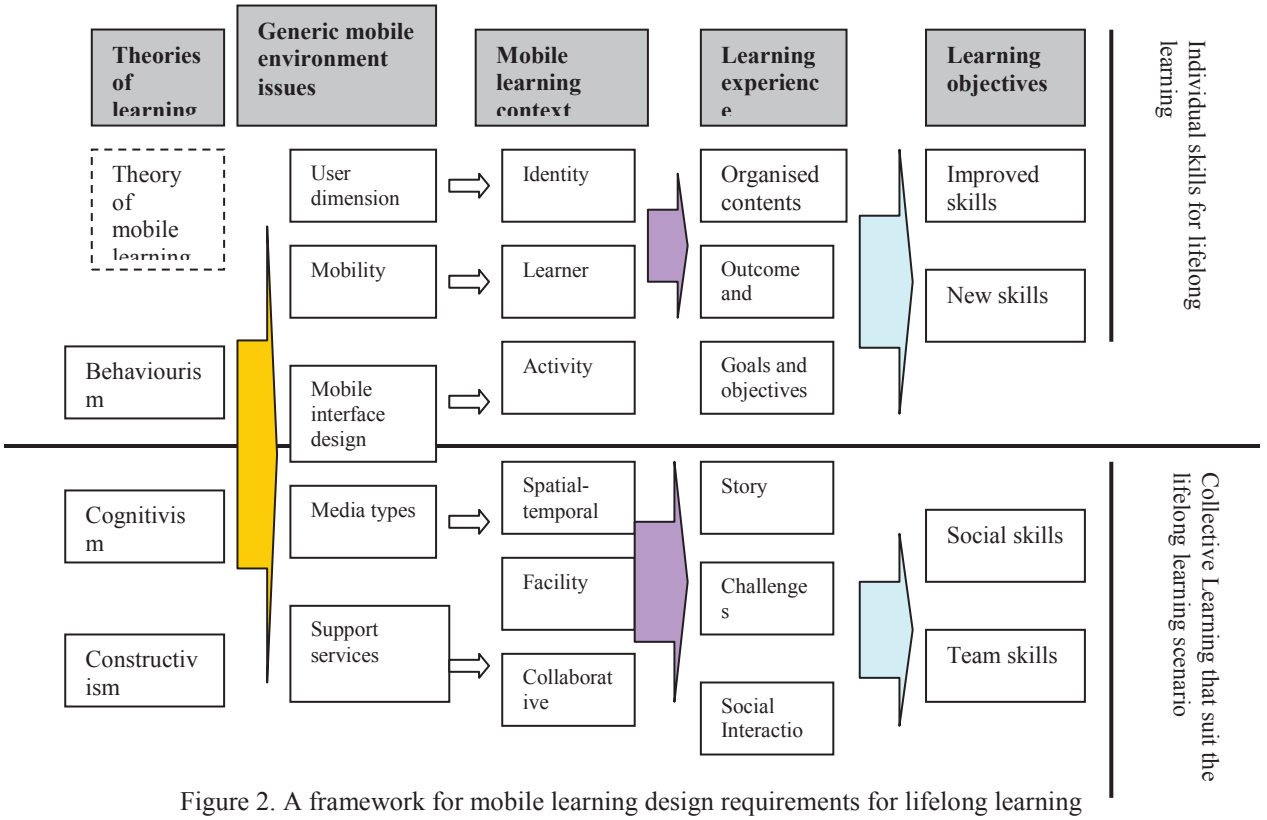

Figure 2. A framework for mobile learning design requirements for lifelong learning

7. Conclusion

This paper discussed the factors and requirements which are seen as important in designing and developing a mobile learning environment. The factors and requirements mentioned are based on literature of good practices, and the framework proposed by Parsons et al. (2007) dominated the discussion of this paper (Norshuhada & Syamsul Bahrin, 2010). However, it is felt that a certain contribution is made to the framework by adding another factor: theories of learning. The framework is inline with the research done by Cochrane (2009). A project on designing mobile content has been embarked on with the postgraduate students of UKM (Universiti Kebangsaan Malaysia). The project has been developed using the proposed framework. For the project, support services have been included in the form of group discussion, forums and blogs. It is hoped that by the end of the project, learners will have improved their current skills, learnt some new ones, sharpened their social skills and acquired teamwork skills. It is also hoped that the proposed framework will provide forwarding engineering support for the successful design of the future mobile lifelong learning systems. After all, lifelong learning is about encouraging learners to learn!

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